

A REVISION OF THE BLASTOIDS "*MESOBLASTUS ? AUSTRALIS*,"
 "*GRANATOCRINUS ? WACHSMUTHII*," AND "*TRICOELOCRINUS ?*
CARPENTERI," DESCRIBED BY ETHERIDGE (1892) FROM THE
 CARBONIFEROUS OF QUEENSLAND

R. G. MCKELLAR

Geological Survey of Queensland

ABSTRACT

The type specimens of the three blastoids, *Mesoblastus ? australis*, *Granatocrinus ? wachsmuthii*, and *Tricoelocrinus ? carpenteri*, described by Etheridge (1892) from the "Permo-Carboniferous Gympie Beds" of the Rockhampton district, Queensland are shown to be conspecific. The species is redescribed and its morphology considered to be sufficiently distinctive to warrant its assignment to a new genus, for which the name *Malchiblastus* is proposed, with *Mesoblastus ? australis* as type species. The genus is tentatively regarded as a member of the Granatoecrinidae, and its affinities discussed. From the associated fauna a probable middle Westphalian age is suggested.

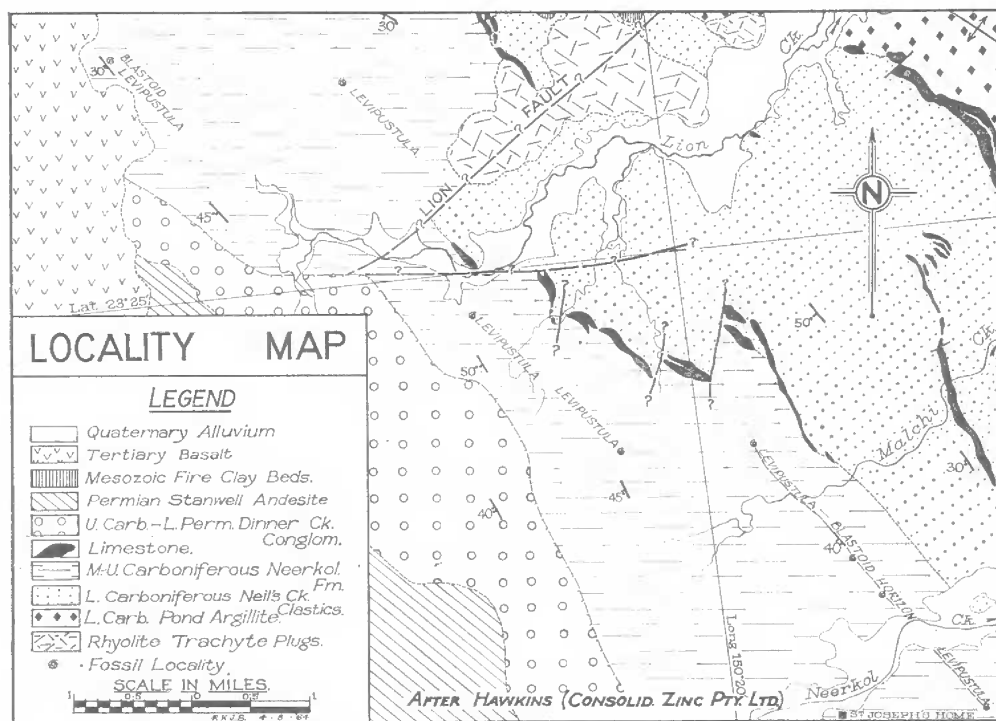
Etheridge (1892) described and figured three incomplete blastoids from the "Permo-Carboniferous Gympie Beds" of the Rockhampton district as *Mesoblastus ? australis*, *Granatocrinus ? wachsmuthii* and *Tricoelocrinus ? carpenteri*. Re-examination of the three type specimens, in the first instance by Mr. J. T. Woods, Director of the Queensland Museum, and subsequently by the author, has shown them to be conspecific.

The diversity of appearance exhibited by these specimens seems to result principally from the severe crushing experienced subsequent to burial, and also from the mode of preservation as internal and external moulds. *M. ? australis* was based on the external mould of an immature calyx which had been crushed almost flat and its constituent plates dislocated and fractured. The type of *T. ? carpenteri* is the internal mould of a large incomplete calyx, similarly flattened, but with relatively little plate dislocation. Its counterpart, an external mould, was also present in the Queensland Museum (Q.M.) collections, but was apparently overlooked by Etheridge. Each of these specimens (preserved in an indurated, fine, lithic sandstone) was collected by E. K. Ogg in 1886 from the Rockhampton district. The precise locality is unknown, but the material compares closely with specimens

in the Geological Survey of Queensland (G.S.Q.), collected by W. H. Rands in 1891 from Malchi Creek, approximately $3\frac{1}{4}$ miles east-north-east of Stanwell, in the lower part of the Neerkol Formation (text-fig. 1). Three of the specimens collected by Rands were borrowed by J. A. Bather of the British Museum in 1893, but to the best of my knowledge, results of his examination were never published. *G. ? wachsmuthii*, the most fragmentary specimen, is essentially the external mould of a single deltoïd, fractured along its length, and portion of the adjacent ambulacrum. It was collected by J. Smith in 1890 from Stanwell, probably along Neerkol Creek. The species was tentatively reassigned to the genus *Orbitremites* by Bather (1899), but no reasons were advanced for the change.

Following these early collections of Ogg, Smith, and Rands, no further blastoids were discovered in the area until 1962, when Professor D. Hill and Mr. G. W. Tweedale collected two incomplete specimens from the Neerkol Formation, $7\frac{1}{2}$ miles north-west of Stanwell ($\frac{3}{4}$ mile along a track diverging to the east from the Stanwell to Dalma road, about 8 miles from Stanwell). Three additional blastoids were later collected by the author from this locality.

Terminology applied in description of blastoid morphology follows that of Fay (1961b).



Text-figure 1.—Blastoid localities near Stanwell, Q.

Order **SPIRACULATA** Jaekel, 1918Family ? **GRANATOCRINIDAE** Fay, 1961Genus **MALCHIBLASTUS** nov.

TYPE SPECIES.—*Mesoblastus* ? *australis* Etheridge, 1892; Upper Carboniferous (Westphalian).

DIAGNOSIS.—Large subfusiform to narrowly conical blastoids, with moderately short pelvis at maturity. Radials long, the substance of the plate continuous beneath the ambulacra. Deltoids a little shorter than radials; two spiracles embayed near adoral extremity. Radia's overlap deltoids; radio-deltoid suture V-shaped in juveniles, M-shaped at maturity. Ambulacra linear, side plates very numerous, lancet exposed medially; one large pore between each side plate along deltoid and radial margins. Four very short hydrosphere folds on each side of ambulacra; aboral to radio-deltoid suture folds enter radials, splay abmedially and terminate within a short distance.

The characters of this blastoid clearly establish that it belongs to a new genus, even though the disposition of deltoids in the anal interarea, and the relation of spiracles to the anus are not known. The name *Malchiblastus* is derived from Malchi Creek near Stanwell.

The subfusiform to steeply conical calyx shape, together with the presence of two spiracles in each deltoid, relates *Malchiblastus* with genera listed in the classification of Fay (1964, pp. 84–5) as members of the families Troosticrinidae Bather and Granatocrinidae Fay.

Among the Troosticrinidae, *Tricoelocrinus* Meek and Worthen, from the Mississippian of North America, has much in common with *Malchiblastus*, particularly in the structure of the hydrospheres and radial plates. Fay (1961b, p. 104) has indicated that *T. woodmani* (Meek and Worthen), the type, has “three short hydrosphere folds on each side of an ambulacrum extending only one-half way down each ambulacrum and ending within the substance of the thick radial plates beneath the ambulacra”. The termination of the hydrospheres in the adoral portion of the thickened radial of *T. obliquatus* (Roemer) was illustrated by Etheridge and Carpenter (1886, pl. 18, figs. 10–13). The structures are closely analogous to those in *Malchiblastus* and it is likely that Etheridge (1892, p. 212) was influenced by them when he tentatively referred his single internal mould to *Tricoelocrinus*. In both genera radials overlap deltoids at their adoral margin. Although apparently allied in the above respects, *Tricoelocrinus* is readily distinguished by its broadly flaring radials and short deltoids, and by its paired spiracles (Fay, 1961a, p. 90, text-figs. 1, 2).

Schizotremites Reimann from the Middle Devonian of North America has a broadly similar calyx shape to *Malchiblastus*, but the deltoids are very short, the spiracles narrow, closely spaced and slit-like, and the hydrospheres (4–6) are pendent and apparently extend the length of the ambulacrum. Macurda (1964, p. 108) recommended that the use of the term “paired” in description of its spiracles should be avoided, although Fay (1964, p. 84) included *Schizotremites* in the Troosticrinidae, characterised by “five paired spiracles; theca conical”.

The type species of *Pyramiblastus* Macurda, *P. fusiformis* (Wachsmuth and Springer), is more closely comparable, in calyx shape and proportions, to *Malchiblastus australis* than any other blastoid known to the author; this applies particularly to immature specimens of the latter, in which vault and pelvis are nearly equal. Spiracles in *Pyramiblastus*, like those of *Schizotremites*, are very closely spaced, but separated by a narrow crest; they seem transitional between the paired condition of the Troosticrinidae and the clearly separated condition of the Granatoocrinidae. In addition to its very closely spaced spiracles, *P. fusiformis* differs from *M. australis* in its adorally embayed radials, the manner in which deltoids overlap radials, and the occurrence of six hydrospires in each group. It is not clear from descriptions of the species whether hydrospires are short or pendent. *Pyramiblastus* is known only from the Lower Mississippian of North America.

Calycoblastus Wanner from the Permian of Timor is the only genus referred by Fay (1964) to the Granatoocrinidae that has similar calyx shape to *Malchiblastus*; all other genera, including *Mesoblastus* Etheridge and Carpenter and *Granatocrinus* Hall, to which specimens of *M. australis* were tentatively referred by Etheridge (1892), have a somewhat globose calyx. *Calycoblastus* is distinguished by its relatively short deltoids, side plates which completely cover the lancet, five pendent hydrospires, and fused hydrospire plate (Wanner, 1924, p. 39, fig. 7).

Bather (1899) referred "*G. ? wachsmuthii*" to *Orbitremites* Austin and Austin. This genus has a globular calyx, only five spiracles and one hydrospire fold on each side of the ambulaera.

Malchiblastus is tentatively placed in the Granatoocrinidae on the basis of its relatively well separated spiracles and calyx shape. The structure of the hydrospires and radials suggests that it may have evolved from *Tricoelocrinus*, even though calyx shape is most like that of *Pyramiblastus*.

MALCHIBLASTUS AUSTRALIS (Etheridge fil.)

(Plate 24, figures 1-7)

Mesoblastus ? *australis* Etheridge, 1892, p. 210, pl. 44, fig. 2.

Granatocrinus ? *wachsmuthii* Etheridge, 1892, p. 211, pl. 7, fig. 10.

Tricoelocrinus ? *carpenteri* Etheridge, 1892, p. 212, pl. 44, fig. 3.

Orbitremites ? *wachsmuthi* (Etheridge), Bather, 1899, p. 32.

MATERIAL.—Holotype, F.1193 (Q.M.) (holotype of *Mesoblastus* ? *australis* Etheridge) probably from the lower part of the Neerkol Formation, Malchi Creek, Stanwell. Figured specimens, F.1195 (Q.M.) (holotype of *Tricoelocrinus* ? *carpenteri* Etheridge), F.8289 (G.S.Q.), F.8294 (G.S.Q.), all probably from the lower part of the Neerkol Formation, Malchi Creek, Stanwell; F.1591 (G.S.Q.) (holotype of

Granatocrinus ? *wachsmuthii* (Etheridge), probably from Neerkol Creek, Stanwell. Mentioned specimen, F.9452 (G.S.Q.), from $7\frac{1}{2}$ miles north-west of Stanwell (map reference 178855 Ridgeland's 1-mile military sheet). Four other incomplete specimens from Malchi Creek, two from Neerkol Creek downstream from St. Joseph's Home, and four from $7\frac{1}{2}$ miles north-west of Stanwell.

DIAGNOSIS.—As for genus.

DESCRIPTION.—The calyx is large, subfusiform to steeply conical in side view, pentagonal in oral view. Vault slightly greater than pelvis in the young, but towards maturity the vault approaches three-quarters of the calyx height. Greatest width is at the aboral extremities of the ambulacra.

The basal circlet has three moderately spreading, normally disposed plates which form an inverse cone between one-third and one-half the height of the pelvis. The azygous basal is quadrilateral, the larger plates hexagonal. Strong growth lines parallel to the inter-basal and basi-radial sutures mark the surface of these plates.

The length of the stem is not known, but 1 cm of it is preserved in F.9452 (G.S.Q.). It is 1.8 mm in diameter and composed of thin disc-like columnals 0.3–0.4 mm thick, each centrally pierced by a round lumen 0.25 mm in diameter. An extremely fine narrow flange 0.25 mm wide encircles each columnal about the midline.

The five radials are elongate, and have almost parallel sides. Growth is most rapid at adoral margins of the radial limbs and the ratio (length radial limb : length plate body) increases from 1 : 1 in juveniles to approximately 3 : 1 in adults. This change in proportions of the radials is reflected in calyx shape, which is transitional from an early subfusiform outline to an almost conical form. In addition, adoral margins of limbs become increasingly peaked towards maturity, allied with distal broadening of ridges laterally bordering the sinus ; the overall effect is to produce an eight-sided radial and sharply M-shaped radio-deltoid suture. Radials clearly overlap deltoids. The species is particularly interesting as the inner surface of the radial is continuous beneath the ambulacrum. In the young this under-sheath is very thin, but towards maturity it becomes heavily thickened and an elevated wedge shaped area is formed on the inner surface of the calyx. The lancet is supported in a broad, rounded, median longitudinal groove on its upper surface. Radials are ornamented by prominent growth lines and fine granules aligned parallel to the plate margins.

The four deltoids are widely lancet-shaped and a little shorter than the radials. Broad ridges at their lateral margins are continuous with those on adjacent radial limbs. Just aboral to the adoral extremity of each deltoid (0.5 mm), lateral margins are embayed by a pair of elongate spiracles, each approximately 1.3 mm in length. In this apical portion of the deltoid, the inner surface is thickened and elevated to form a low platform, and expands laterally as a narrow ledge which projects beyond the plate margins visible in external view. In mature specimens the platform is 3.5–4 mm long and two fine parallel ridges extend proximally for 2 mm from its aboral margin. On F.8289 (G.S.Q.) deltoids are 1.2 mm thick medianly. They are ornamented by very strong growth lines parallel to the radio-deltoid suture, but usually no granules. A pair of exceedingly fine, linear surface incisions extend from the apical area of each deltoid, just inside the marginal ridge to the aboral margin ; their presence cannot be explained. The arrangement of deltoids in the anal interarea is not known.

Five linear ambulacra have the lancet covered by side plates, except in the median line where it is exposed over 0.1 mm along the entire length. Side plates are moderately broad and 80–85 are present on each side of an ambulacrum, i.e. approximately 2 per millimetre. Outer side plates at adoral abmedial edges of side plates are small and almost semi-circular in outline. Triangular pores lie between aboral margins of side plates, adoral margins of outer side plates and the adjacent radial or deltoid margin. Beneath the side plates, between the lancet and radial or deltoid the pores are circular and have a diameter of 0.2–0.25 mm. Side plates bear a pronounced pore furrow on their outer face, and eight cover plate sockets admedially.

Four hydrosphere folds appear to be developed on each side of the ambulacra; they are very short and appear as low rounded ridges on the inner surface of the calyx. Aboral to the radio-deltoid suture the folds enter the substance of the radial, splay abmedially, the outermost almost at right angles to the ambulacrum, and terminate within a short distance.

DIMENSIONS (mm)

	CALYX	BASALS	DELTOIDS	RADIALS	AMBULACRA
	length width	length width	length width	length width	length width
F.1193 (Q.M.) Holotype	24 x 16	4 x 5	8 x 5	13 x 7	15 x 2
F.1195 (Q.M.) fig. spec.	— x 28	— x —	23 x 12	23 x 17	40 x 2.6
F.8294 (G.S.Q.) fig. spec.	— x —	— x —	21 x 14	23 x 17	42 x 2.6

N.B.—Specimens are crushed almost flat and width measurements of the calyx considerably exaggerated.

Of the three names used for the conspecific blastoids by Etheridge (1892), *Mesoblastus* ? *australis* has page priority, and hence *Granatocrinus* ? *wachsmuthii* and *Tricoelocrinus* ? *carpenteri* are regarded as its synonyms. It should perhaps be noted that the specific name *wachsmuthii* is almost certainly a misprint in the heading to Etheridge's description (1892, p. 211), as it is spelled *wachsmuthi* elsewhere in that publication.

Malchiblastus australis is directly associated with a moderately diverse fauna which includes *Fistulammina frondescens* Crockford, *Fenestella micropora* (Crockford), *Polypora neerkolensis* Crockford, *Streptorhynchus* sp., *Levipustula levis* Maxwell, *Spinuliplica spinulosa* Campbell, *Sanguinolites* sp., and *Acrocrinus* sp. The fauna is typical of the *Levipustula* beds in the lower part of the Neerkol Formation, which Maxwell (1951) regarded as Moscovian in age. The age determination was confirmed by Campbell (1961), who described a closely comparable fauna, including a blastoid radial like those of *M. australis*, from the Booral Formation (Upper Kuttung Series) in New South Wales, and deduced a probable middle Westphalian age.

Two other Carboniferous blastoids are known from the Monto district in Queensland. *Nymphaeoblastus bancroftensis* McKellar was described from Lower Carboniferous (Viséan) strata $3\frac{1}{2}$ miles east-south-east of Bancroft (McKellar, 1964), and a single long deltoid has recently been collected by the author from the Westphalian Branch Creek Formation, 4 miles east of Dakiel.

ACKNOWLEDGEMENTS

The writer wishes to thank Mr. J. T. Woods (Queensland Museum) for the loan of two of Etheridge's type specimens, Dr. D. B. Macurda Jr. (University of Michigan) for his valuable comments on the blastoids morphology, and C. R. A. Exploration Pty. Ltd. for permission to use geological maps of the Mt. Morgan-Rockhampton district, compiled for them by B. Hawkins and I. G. Whiteher, in the preparation of the locality map.

LITERATURE CITED

- Bather, F. A., 1899. The genera and species of Blastoidea, with a list of specimens in the British Museum (Natural History). London.
- Campbell, K. S. W., 1961. Carboniferous fossils from the Kuttung rocks of New South Wales. *Palaontology*, 4, pp. 428-474.
- Etheridge, R. Jr., 1892, in Jack, R. L., and Etheridge, R. Jr. The geology and palaontology of Queensland and New Guinea. *Publ. geol. Surv. Qd*, 92, pp. 1-768.
- Etheridge, R. Jr., and Carpenter, P. H., 1886. Catalogue of the Blastoidea in the Geological Department of the British Museum (Natural History). London.
- Fay, R. O., 1961a. The type of *Tricoelocrinus* Meek and Worthen. *Okla. Geology Notes*, 21, pp. 90-94.
- , 1961b. Blastoid studies. Echinodermata, Art. 3. *Univ. Kansas, Paleont. Contrib.*, 27, pp. 1-147.
- , 1964. An outline classification of the Blastoidea. *Okla. Geology Notes*, 24, pp. 81-90.
- Macurda, D. B. Jr., 1964. A new spiraculate blastoid, *Pyramiblastus*, from the Mississippian Hampton Formation of Iowa. *Contrib. Mus. Pal., Univ. Michigan*, 19, pp. 105-114.
- Maxwell, W. G. H., 1951. Upper Devonian and Middle Carboniferous brachiopods of Queensland. *Pap. Dep. Geol. Univ. Qd*, 3 (14), pp. 1-27.
- McKellar, R. G., 1964. A new species of *Nymphaeoblastus* (Blastoidea) from the Lower Carboniferous of Queensland. *Mem. Qd Mus.*, 14, pp. 101-105.
- Wanner, J., 1924. Die Permischen Echinodermen von Timor. Teil 2. *Palaont. Timor*, 14 (23), pp. 1-81.

EXPLANATION OF PLATE XXIV

Malchiblastus australis (Etheridge fil.)

- Fig. 1. Side view of deltoid and portion of ambulacrum, F.1591 (G.S.Q.), holotype of *Granatocrinus ? wachsmuthii* Etheridge fil. Latex cast from external mould, X 2.
- Fig. 2. Side view of incomplete calyx, F.1195 (Q.M.), counterpart of holotype of *Tricoelocrinus ? carpenteri* Etheridge fil. Latex cast from external mould, X 1.5.
- Fig. 3. Side view of internal mould of calyx, F.1195 (Q.M.), holotype of *Tricoelocrinus ? carpenteri* Etheridge fil., X 1.5.
- Fig. 4. Side view of holotype, a severely crushed calyx, F.1193 (Q.M.). Latex cast from external mould, X 2.
- Fig. 5. Side view of immature calyx, F.8294 (G.S.Q.). Latex cast from external mould, X 2.
- Fig. 6. Oblique detailed view of ambulacrum, F.1195 (Q.M.), same specimen as fig. 2. Latex cast from external mould, X 8.
- Fig. 7. Side view of large crushed calyx, F.8289 (G.S.Q.). Latex cast from external mould, X 1.5.